

IN THE CLAIMS

A complete listing of the pending claims follows:

Claims 1 ~ 108. (cancelled)

109. (currently amended) An in-process ratio mass spectrometry system, comprising:

a spike reservoir;

a spike dilution apparatus configurable to dilute a spike from the spike reservoir having a first concentration to produce a processed spike having a diluted second concentration;

a mixer configurable to mix the processed spike and an extracted sample having at least one analyte to permit equilibration therebetween;

an atmospheric pressure ionizer (API) configurable to ionize the equilibrated extracted sample and processed spike to produce ions;

a mass spectrometer configurable to process the ions by ratio determination; and

a control system adapted to automatically configure the components spike dilution apparatus, the mixer, and the API in the in-process ratio mass spectrometry system such the sample is automatically mixed with the processed spike, ionized, and processed by the mass spectrometer, the control system being further configured to use the ratio measured by the mass spectrometer to characterize the concentration of the at least one analyte in the extracted sample.

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110. (previously presented) The system of claim 109, further comprising:

a sample extraction apparatus configured to extract the extracted sample from at least one process solution, wherein the control system is further configured to control the sample extraction apparatus such that the extracted sample has a predetermined volume.

111. (previously presented) The system of claim 110, wherein the at least one process solution comprises a plurality of process solutions, the sample extraction apparatus being further configured to extract the sample from a process solution selected from the plurality of process solutions as controlled by the control system.

112. (previously presented) The system of claim 109, further comprising a chemical modification apparatus configured to chemically modify the processed spike.

113. (previously presented) The system of claim 109, wherein the spike dilution apparatus includes a plurality of dilution sub-modules arranged from first dilution sub-module to a last dilution sub-module, wherein each dilution sub-module is configurable to achieve a dilution selected from a range of possible dilutions, wherein the first dilution sub-module is configurable to dilute the spike having the first concentration to a first diluted concentration, the second dilution sub-module is configurable to dilute the spike at the first diluted concentration to a second diluted concentration, and so on such that the last dilution sub-module is configurable to provide the spike diluted to a last diluted concentration, and wherein the control system is operable to configure the appropriate

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combination of dilution sub-modules to produce the processed spike having the second concentration.

114. (previously presented). The system of claim 113, wherein the range of possible dilutions for each dilution sub-module is from 1 to approximately 30.

115. (previously presented) The system of claim 113, wherein the range of possible dilutions for each dilution sub-module is such that the last diluted concentration may be six orders of magnitude more diluted than the first concentration.

116. (previously presented) The system of claim 113, wherein each sub-module is configurable to achieve its dilution by pumping the solution it is diluting into a dilution mixer at a first flow rate and by pumping the diluent into the dilution mixer at a second flow rate.

117. (previously presented) The system of claim 116, wherein the dilution mixer comprises a conduit junction having a first input conduit for receiving the solution being diluted and a second input conduit for receiving the diluent, the first and second input conduits being arranged with respect to an output conduit such that solution being diluted and diluent undergo substantial direction change before flowing out of the output conduit to affect mixing therebetween.

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118. (previously presented) The system of claim 109, wherein the spike dilution apparatus is configurable to select from a plurality of spike sources to produce the spike having the first concentration.

119. (previously presented) A method of automatically analyzing an analyte, comprising:
diluting a spike having a first concentration to produce a processed spike having a second concentration; wherein the second concentration is selected based upon an estimate of a concentration of the analyte in a sample;
mixing the processed spike and the sample to produce an equilibrated mixture of the processed spike and sample;
ionizing the equilibrated mixer using an atmospheric-pressure-ionizer to produce ions;
processing the ions in a mass spectrometer to produce a response ratio; and
characterizing the concentration of the at least one analyte using the response ratio.

120. (previously presented) The method of claim 119, wherein the response ratio is an isotopic ratio.

121. (previously presented) The method of claim 119, wherein the second concentration is selected based upon the estimated concentration such that the mass spectrometer will provide a ratio response with adequate resolution to determine the concentration of the at least one analyte.

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122. (previously presented) The method of claim 119, further comprising: selecting the sample from a plurality of process solutions.

123. (previously presented) The method of claim 119, wherein the diluting the spike act comprises successively diluting the spike having the first concentration to produce the processed spike having the second concentration.

124. (previously presented) The method of claim 123, further comprising: appropriately selecting the dilution achieved in each successive dilution so as to produce the processed spike having the second concentration.

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